The BUET Logo Heist: The DFT Challenge!

CSE 220 Online on DFT

Section B

Time: 40 minutes

Scenario

A dark day has dawned at BUET! An alien named Maximus, has stolen and encrypted the iconic BUET logo, the pride of the university. Unfortunately, it was the only one copy left—the last remaining copy of the logo that represents BUET's legacy. Without it, BUET's digital identity will crumble, the classrooms will lose their essence, and the reputation of BUET as the fortress of engineering excellence will be at stake!

Encryption process: Maximus selected one row of pixels from the BUET logo as the "key row" and circularly convolved it with all other rows of the image. The key row itself was left unencrypted.

Maximus left one **clue** to detect the **key-row**: the key row is humble—its pixel values are much smaller compared to all the encrypted rows.

Your Mission

As the pride of BUET, your mission is clear:

- **Identify the key row**: At first, use the clue mentioned above to find out the index of the key-row. The encrypted image has already been loaded in the code given to you.
- **Decrypt the BUET logo**: Use the mighty power of Discrete Fourier Transform (DFT) to reverse the circular convolution and restore the image to its original state.

Without your brilliance, the iconic BUET logo will be lost forever. Will you rise to the challenge, outsmart the alien, and restore the logo of BUET? The DFT is your key—use it wisely and save the day!

Hint

For detecting the key-row, just find the index of the smallest value of any column of the image. For decryption, use the circular Convolution property of DFT:

$$\mathrm{DFT}\big(x(n) \circledast key(n)\big) = X(k) \cdot KEY(k)$$

Submission

Just submit a single python file after renaming it with your student ID: 2105XXX.py